John W. Hickenlooper, Governor
Christopher E. Urbina, MD, MPH
Executive Director and Chief Medical Officer

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Colorado Department of Public Health and Environment

January 4, 2011

Brian Daw, P.E.
Frachetti Engineering, Inc.
1790 Platte Street
Denver, CO 80202

Re: PEL200273, Modifications to the previously proposed *E. coli*, dissolved As, total recoverable As, and dissolved Se effluent limits of the 3/27/2010 St. Vrain Sanitation District WWTF PEL

Dear Mr. Daw:
The Water Quality Control Division (Division) of the Colorado Department of Public Health and Environment has modified the Preliminary Effluent Limits (PELs) for the expansion of the proposed St. Vrain SD wastewater treatment facility (WWTF). In review of the PEL, an error was discovered in the calculation of the Antidegradation Based Average Concentration (ADBAC) for dissolved selenium and in the process of updating the limits for this parameter; updates were made based on standards changes for arsenic and the removal of *E. coli* from the 305(b) list for Monitoring and Evaluation.

Specifically, the rolling 2-year average effluent limitation (ADBAC) for dissolved selenium was changed from 1.9 µg/l to 3.2 µg/l. This change was made because the limitation should never be more stringent than the standard. In this case, the ADBAC should never be more stringent than the SCT (significant concentration threshold, i.e. antidegradation standard).   Note also that the ambient water quality data in Table A-6 has been updated to correctly reflect the data used in the calculations of the effluent limits. Previously this table reflected 3.0 µg/l as the 85^{th} percentile for selenium, however this data was from 1998 and 1999. This does not change the baseline water quality (BWQ) as the BWQ is determined by the 1998 to 2000 period of record.

Due to changes in the 305(b) listing on this stream segment, the *E. coli* limitations were also updated. The *E. coli* limits were changed from 252 #/100 ml (7-day average) and 126 #/100 ml (30-day average), to 484 #/100ml (7-day average) and 242 #/100ml (30-day average), based on the current water quality data and stream standards. The water quality based effluent limits for dissolved and total recoverable arsenic have not changed, but in review of the PEL calculations it was noted that the full range of potential limitations were not included in the table in the letter. The full range of potential limits have been added to Table 1.

All other effluent limits stay the same as the 3/27/2010 PEL. These effluent limits were developed, as detailed in the attached document, for use as one of the submittals in your application for Site Approval.

PELs developed for the WWTF (Table 1) are based on effluent limits for pollutants of concern as established in the *Regulations for Effluent Limitations* (Regulation No. 62), and water quality-based effluent limits (see the analysis in the attached document) necessary for protection of the water quality in the receiving water. With a proposed hydraulic design capacity of 6 million gallons per day (MGD) and discharge into St. Vrain Creek, which is identified as stream segment COSPSV03, the St. Vrain SD WWTF will require an individual permit. A PELs evaluation is attached to document the findings and decisions that were used to derive the PELs in Table 1.

Table 1 **Proposed St. Vrain Sanitation District WWTF Expansion** **Preliminary Effluent Limits for Discharge to St. Vrain Creek**		
Technology Based Limits		
BOD_5 (mg/l)	45 (7-day average), 30 (30-day average)	
BOD_5 (% removal)	85 (30-day average)	
TSS, mechanical plant (mg/l)	45 (7-day average), 30 (30-day average)	
TSS, mechanical plant (% removal)	85 (30-day average)	
Oil and Grease (mg/l)	10 (maximum)	
pH (s.u.)	6.5-9.0 (minimum-maximum)	
Total Ammonia		
Month	*WQBEL (mg/l)*	*ADBAC (mg/l)*
January	14 (Daily Max.), 13 (30-day average)	5.1 (2-yr average)
February	14 (Daily Max.), 10 (30-day average)	5.2 (2-yr average)
March	19 (Daily Max.), 9.2 (30-day average)	5.4 (2-yr average)
April	18 (Daily Max.), 7.7 (30-day average)	2.7 (2-yr average)
May	24 (Daily Max.), 8.2 (30-day average)	2.8 (2-yr average)
June	40 (Daily Max.), 7.5 (30-day average)	2.7 (2-yr average)
July	41 (Daily Max.), 4.9 (30-day average)	2.1 (2-yr average)
August	43 (Daily Max.), 4.7 (30-day average)	2.1 (2-yr average)
September	36 (Daily Max.), 6.3 (30-day average)	2.4 (2-yr average)
October	41 (Daily Max.), 13 (30-day average)	3.7 (2-yr average)
November	35 (Daily Max.), 22 (30-day average)	5.5 (2-yr average)
December	25 (Daily Max.), 21 (30-day average)	6.1 (2-yr average)
Other Parameters		
	WQBEL	*ADBAC*
TRC (mg/l)	0.046 (Daily Max.), 0.026 (30-day average)	0.0041 (2-yr average)
Ag (dis) *(µg/l)*	53 (Daily Max.), 8.4 (30-day average)	1.3 (2-yr average)
As (trec) *(µg/l)*	18 (30-day average)	2.7 (2-yr average)
As (dis) *(µg/l)*	815 (Daily Max.)	NA
Cd (dis) *(µg/l)*	22 (Daily Max.), 2.9 (30-day average)	0.43 (2-yr average)
CrIII (dis) *(µg/l)*	4,251 (Daily Max.), 554 (30-day average)	84 (2-yr average)
CrVI (dis) *(µg/l)*	38 (Daily Max.), 26 (30-day average)	4.0 (2-yr average)

Cu (dis) *(µg/l)*	118 (Daily Max.), 68 (30-day average)	15 (2-yr average)
Fe (trec) *(µg/l)*	2,006 (30-day average)	846 (2-yr average)
Hg (tot) *(µg/l)*	0.024 (30-day average)	0.004 (2-yr average)
Mn (dis) *(µg/l)*	11,300 (Daily Max.), 6,216 (30-day average)	5,621 (2-yr average)
Ni (dis) *(µg/l)*	3,628 (Daily Max.), 403 (30-day average)	62 (2-yr average)
Pb (dis) *(µg/l)*	674 (Daily Max.), 26 (30-day average)	4.1 (2-yr average)
Se (dis) *(µg/l)*	38 (Daily Max.), 5.2 (30-day average)	3.2 (2-yr average)
Zn (dis) *(µg/l)*	1,089 (Daily Max.), 940 (30-day average)	696 (2-yr average)
Temperature (C°)	Monitor	NA
CN (Free) (mg/l)	0.012 (Daily Max.)	0.002 (2-yr average)
E. coli (#/100 ml)	484 (7-day average), 242 (30-day average)	NA

Table 1 contains a summary of the limitations for BOD, TSS, pH, Oil and Grease, E. coli, ammonia, and total residual chlorine, for which the proposed treatment facility will be evaluated against, under the Site Approval Process. This evaluation will include a determination of whether the proposed treatment facility as designed, can meet these limitations.

Effluent limits for metals and cyanide are also presented in this PEL, for which the proposed treatment facility may or may not be evaluated against, under the Site Approval Process. The limitations for these parameters may be able to be met by the development of a pretreatment program, the refinement of local limits under an existing pretreatment program, or other methods of source water control. In these instances, the ability of the facility to meet these limitations will not be reviewed under the Site Approval process and are the responsibility of the permittee. If treatment or other operational control method is to be used specific to a parameter(s) in this table, the ability of the facility to meet the limitation(s) will be reviewed under the Site Approval process.

Additionally, since the receiving water is subject to antidegradation-based effluent limits, two-year rolling-average limits have been determined. These are presented under ADBACs in Table 1. In effect, only the assimilative capacity limits apply until sufficient effluent data (two cycles) are collected to report the rolling average. Thus, the facility is expected to meet the ADBACs after two years of operation.

Compliance with the proposed dissolved effluent limitations in the permit will be based on a potentially dissolved analysis, while compliance with the total recoverable effluent limitations will be based on a total recoverable analysis.
If you have any questions regarding this matter, please contact me at (303) 692-3608.

Sincerely,

Eric T. Oppelt, P.E.
Water Quality Control Division
Permits Section

cc: Doug Camrud, WQCD – Engineering Section

PEL-200273 file

APPENDIX A
Preliminary Effluent Limits
St. Vrain Creek
St. Vrain Sanitation District St. Vrain SDWWTF

Table of Contents

I. Preliminary Effluent Limits Summary

Table A-1 includes summary information related to this PEL. This summary table includes key regulatory starting points used in development of the PEL such as: receiving stream information; threatened and endangered species; 303(d) and 305(b) listings; low flow and facility flow summaries; and a list of parameters evaluated.

<table>
<tr><th colspan="7">Table A-1
PEL Summary</th></tr>
<tr><th colspan="7">Facility Information</th></tr>
<tr><th colspan="3">Facility Name</th><th colspan="2">PEL Number</th><th>Design Flow (max 30-day ave, MGD)</th><th>Design Flow (max 30-day ave, CFS)</th></tr>
<tr><td colspan="3">St. Vrain SD WWTF</td><td colspan="2">PEL-200273</td><td>6</td><td>9.3</td></tr>
<tr><th colspan="7">Receiving Stream Information</th></tr>
<tr><th colspan="2">Receiving Stream Name</th><th>Segment ID</th><th>Designation</th><th colspan="3">Classification(s)</th></tr>
<tr><td colspan="2">St. Vrain Creek</td><td>COSPSV03</td><td>Undesignated</td><td colspan="3">Aquatic Life Warm 1, Recreation Class E, Agriculture</td></tr>
<tr><th colspan="7">Low Flows (cfs)</th></tr>
<tr><th colspan="2">1E3 (1-day)</th><th colspan="2">7E3 (7-day)</th><th colspan="2">30E3 (30-day)</th><th>Ratio of 30E3 to the Design Flow (cfs)</th></tr>
<tr><td colspan="2">13</td><td colspan="2">13</td><td colspan="2">13</td><td>1.4:1</td></tr>
<tr><th colspan="7">Regulatory Information</th></tr>
<tr><th>T&E Species</th><th>303(d) (Reg 93)</th><th>Monitor and Eval (Reg 93)</th><th colspan="2">TMDL Status</th><th>Temporary Modification(s)</th><th>Control Regulation</th></tr>
<tr><td>No</td><td>None</td><td>Aquatic Life Use</td><td colspan="2">Old NH3 TMDL Done</td><td>NH3(ac)=TVS(old) NH3(ch)=0.06 (Type i). Expiration date of 12/31/2011.</td><td>None</td></tr>
<tr><th colspan="7">Pollutants Evaluated</th></tr>
<tr><td colspan="7">Ammonia, E. coli, Total Residual Chlorine, BOD, TSS, pH, Metals, Cyanide</td></tr>
</table>

II. Introduction

The Preliminary Effluent Limits (PEL) of St. Vrain Creek near the St. Vrain SD Wastewater Treatment Facility (SVSD WWTF), located in Weld County, is intended to determine the assimilative capacities available for pollutants found to be of concern. This PEL describes how the water quality based effluent limits (WQBELs) are developed. These parameters may or may not appear in the permit with limitations or monitoring requirements, subject to other determinations such as reasonable potential analysis, evaluation of federal effluent limitation guidelines, implementation of state-based technology based limits, mixing zone analyses, 303(d) listings, threatened and endangered species listing, or other requirements as discussed in the permit rationale. Figure A-1 contains a map of the study area evaluated as part of this PEL.

St. Vrain SD WWTF Area

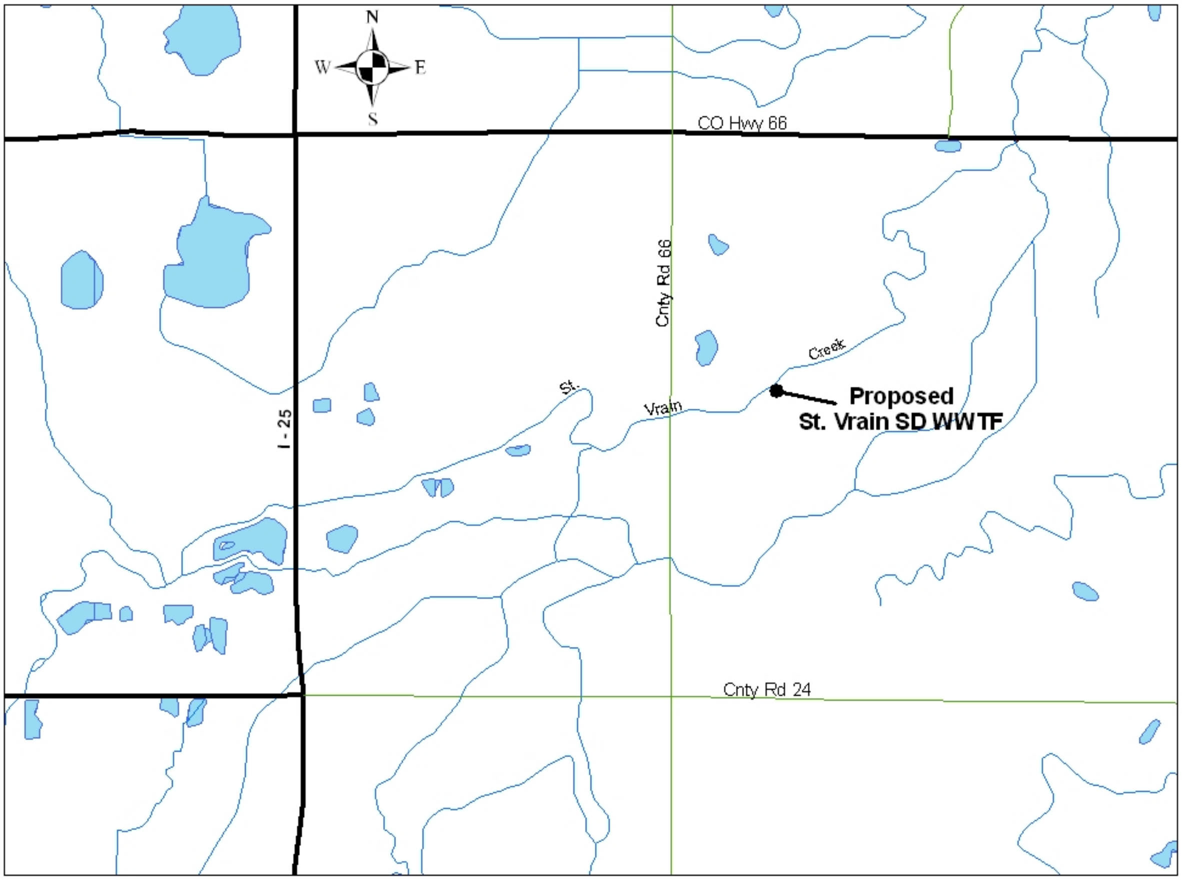

FIGURE A-1

The SVSD WWTF discharges to St. Vrain Creek, which is in the Water Body Identification (WBID) stream segment COSPSV03. This means the South Platte River Basin, St. Vrain Creek Sub-basin, Stream Segment 03. This segment is composed of the "Mainstem of St. Vrain Creek from Hygiene Road to the confluence with the South Platte River". Stream segment COSPSV03 is classified for Warm Water Aquatic Life Class 1, Class E Recreation and Agriculture. This region is becoming urbanized with a quickly growing population, and therefore the assimilative capacities for ammonia in St. Vrain Creek are potentially highly influenced by numerous domestic wastewater treatment plants upstream of the SVSD WWTF. The discharge from SVSD WWTF occurs toward the lower end of a modeled watershed that includes over 70 miles of streams that are the lowest portions of Coal Creek, Boulder Creek, and St. Vrain Creek. These streams are used as a receiving stream by the following dischargers: City of Louisville WWTF (CO-0023078), City of Lafayette WWTF (CO-0023124), Town of Erie WWTF (CO-0021831), Superior Metro District #1 Rock Creek WWTF (CO-0043010), City of Boulder

WWTF (CO-0024147), City of Longmont WWTF (CO-0026671), and Niwot Sanitation District WWTF (CO-0021695). Because of their proximity to each other on the mainstem segments, and relative size, these facilities were modeled in a ammonia TMDL in conjunction with the SVSD WWTF to determine assimilative capacities for ammonia available in St. Vrain Creek. The final modeling report (Report 264) was done by Dr. Bill Lewis and James McCutchan of the CU Center of Limnology. This PEL utilizes information from Report 264 in establishing new ammonia limits and low flows for the SVSD WWTF that are protective of COSPSV03. Note that the previous multi-user modeling of St. Vrain Creek completed as part of the TMDL analysis is not consistent with this current PEL, because the ammonia standard has changed and become more stringent on COSPSV03 since the TMDL was completed. To assure protection of water quality all ammonia limits in this PEL are based on the current ammonia standard, and are more stringent than limits required by the previous ammonia TMDL.

Finally, stream segment COSPSV03 is also included on *Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List, Regulation 93* as a water quality impacted stream for impairment of the Aquatic Life Use.

Information used in this assessment includes data gathered from the SVSD WWTF, Lewis and McCutchan Report 264, Division, U.S. Environmental Protection Agency (EPA), and U.S. Geological Survey (USGS). The data used in the assessment consist of the best information available at the time of preparation of this PELs analysis.

III. Water Quality Standards

<u>Narrative Standards</u>

Narrative Statewide Basic Standards have been developed in Section 31.11(1) of the regulations, and apply to any pollutant of concern, even where there is no numeric standard for that pollutant. Waters of the state shall be free from substances attributable to human-caused point source or nonpoint source discharges in amounts, concentrations or combinations which:

for all surface waters except wetlands;

> *(i) can settle to form bottom deposits detrimental to the beneficial uses. Depositions are stream bottom buildup of materials which include but are not limited to anaerobic sludge, mine slurry or tailings, silt, or mud; or*
> *(ii) form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses; or*
> *(iii) produce color, odor, or other conditions in such a degree as to create a nuisance or harm existing beneficial uses or impart any undesirable taste to significant edible aquatic species or to the water; or*
> *(iv) are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life; or*
> *(v) produce a predominance of undesirable aquatic life; or*
> *(vi) cause a film on the surface or produce a deposit on shorelines; and*

for surface waters in wetlands;

> *(i) produce color, odor, changes in pH, or other conditions in such a degree as to create a nuisance or harm water quality dependent functions or impart any undesirable taste to significant edible aquatic species of the wetland; or*
> *(ii) are toxic to humans, animals, plants, or aquatic life of the wetland.*

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for any parameter of concern could be put in CDPS discharge permits.

<u>Standards for Organic Parameters and Radionuclides</u>

Radionuclides: Statewide Basic Standards have been developed in Section 31.11(2) and (3) of The Basic Standards and Methodologies for Surface Water to protect the waters of the state from radionuclides and organic chemicals.

In no case shall radioactive materials in surface waters be increased by any cause attributable to municipal, industrial, or agricultural practices or discharges to as to exceed the following levels, unless alternative site-specific standards have been adopted. Standards for radionuclides are shown in Table A-2.

Table A-2
Radionuclide Standards

Parameter	Picocuries per Liter
Americium 241*	0.15
Cesium 134	80
Plutonium 239, and 240*	0.15
Radium 226 and 228*	5
Strontium 90*	8
Thorium 230 and 232*	60
Tritium	20,000

*Radionuclide samples for these materials should be analyzed using unfiltered (total) samples. These Human Health based standards are 30-day average values for both plutonium and americium.

Organics: The organic pollutant standards contained in the Basic Standards for Organic Chemicals Table are applicable to all surface waters of the state for the corresponding use classifications, unless alternative site-specific standards have been adopted. These standards have been adopted as “interim standards” and will remain in effect until alternative permanent standards are adopted by the Commission. These interim standards shall not be considered final or permanent standards subject to antibacksliding or downgrading restrictions. Although not reproduced in this PEL, the specific standards for organic chemicals can be found in Regulation 31.11(3).

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for radionuclides, organics, or any other parameter of concern could be put in CDPS discharge permits.

The aquatic life standards apply to all stream segments that are classified for aquatic life. The water supply standards apply only to those segments that are classified for water supply. The water + fish standards apply to those segments that have a Class 1 aquatic life and a water supply classification. The fish ingestion standards apply to Class 1 aquatic life segments that do not have a water supply designation. The water + fish and the fish ingestion standards may also apply to Class 2 aquatic life segments, where fish of a catchable size and which are normally consumed are present, and where fishing occurs on a regular basis.

Because the St. Vrain Creek is classified for Class 1 aquatic life, without a water supply designation, the WQCC has decided fish ingestion, and aquatic life standards apply to this discharge.

Salinity

Salinity: The Division's policy for Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, may be applied to discharges where an agricultural water intake exists downstream of a discharge point. Limitations for electrical conductivity, sodium absorption ratio, or sodium, may be applied in accordance with this policy.

Temperature

Temperature shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life. This standard shall not be interpreted or applied in a manner inconsistent with section 25-8-104, C.R.S. Segment specific Warm Stream Tier I TVS temperature standards have been developed for COSPSV03 and are March – November MWAT = 24.2 °C with the DM = 29 °C, and December – February MWAT = 12.1 °C with the DM = 14.5 °C.

Segment Specific Numeric Standards

Numeric standards are developed on a basin-specific basis and are adopted for particular stream segments by the Water Quality Control Commission. To simplify the listing of the segment-specific standards, many of the aquatic life standards are contained in a table at the beginning of each chapter of the regulations. The standards in Table A-3 have been assigned to stream segment COSPSV03 in accordance with the *Classifications and Numeric Standards for South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin*.

The Water Quality Control Commission has recently completed a preliminary final action concerning the *Classifications and Numeric Standards for South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin*. This PEL has been developed in conformance with the water quality standards that will become effective on March 30, 2010, as any permitting action based on this PEL would take effect after the effective date of this regulation.

Table A-3 In-stream Standards for Stream Segment COSPSV03
Physical and Biological
Dissolved Oxygen (DO) = 5.0 mg/l
pH = 6.5 – 9.0 s.u.
Escherichia coli = 126 colonies/100 ml
Temperature = TVS(WS-I) °C
Inorganic
Total ammonia acute and chronic = TVS
Unionized Ammonia acute = old TVS (Type i) Temp Mod. (Exp. Date 12/31/2011)
Unionized Ammonia chronic = 0.6 mg/l (Type i) Temp Mod. (Exp. Date 12/31/2011)
Chlorine acute = 0.019 mg/l
Chlorine chronic = 0.011 mg/l
Free Cyanide acute = 0.005 mg/l
Sulfur chronic = 0.002 mg/l
Boron chronic = 0.75 mg/l
Nitrite = 0.05 mg/l
Metals
Dissolved Arsenic acute = 340 μg/l
Total Recoverable Arsenic chronic = 7.6 μg/l
Dissolved Cadmium acute and chronic = TVS
Dissolved Trivalent Chromium acute and chronic = TVS
Dissolved Hexavalent Chromium acute and chronic = TVS
Dissolved Copper acute and chronic = TVS
Total Recoverable Iron chronic = 1,000 μg/l
Dissolved Lead acute and chronic = TVS
Dissolved Manganese acute and chronic = TVS
Dissolved Manganese chronic = WS
Total Mercury chronic = 0.01 μg/l
Dissolved Nickel acute and chronic = TVS
Dissolved Selenium acute and chronic = TVS
Dissolved Silver acute and chronic = TVS
Dissolved Zinc acute and chronic = TVS

<u>Table Value Standards and Hardness Calculations</u>

Standards for metals are generally shown in the regulations as Table Value Standards (TVS), and these often must be derived from equations that depend on the receiving stream hardness or species of fish present; for ammonia, standards are discussed further in Section VI of this PEL. The Classification and Numeric Standards documents for each basin include a specification for appropriate hardness values to be used.

Hardness data for St. Vrain Creek near the point of discharge of the SVSD WWTF were insufficient to conduct a regression analysis based on the low flow. Therefore, the Division's alternative approach to calculating hardness was used, which involves computing a mean hardness.

The mean hardness was computed to be 415 mg/l based on sampling data from WQCD station number 31 located on St. Vrain Creek downstream from the SVSD WWTF. The *Basic Standards and Methodologies for Surface Water* indicates that hardness must be capped at 400 mg/l when determining in-stream metal water quality standards using the equations in the TVS. This maximum hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals, with the results shown in Table A-4.

Table A-4

TVS-Based Metals Water Quality Standards for PEL-200273

Based on the Table Value Standards Contained in the Colorado Department of Public Health and Environment Water Quality Control Commission *Regulation 38*

Parameter	***In-Stream Water Quality Standard***			***TVS Formula: Hardness (mg/l) as CaCO3 =*** **400**
Cadmium, Diss.	Acute	9.1	µg/l	$[1.136672-0.041838\ln(hardness)]e^{(0.9151(\ln(hardness))-3.1485)}$
	Chronic	1.2	µg/l	$[1.101672-0.041838\ln(hardness)]e^{(0.7998(\ln(hardness))-4.4451)}$
Chromium III, Diss.	Acute	1773	µg/l	$e^{(0.819(\ln(hardness))+2.5736)}$
	Chronic	231	µg/l	$e^{(0.819(\ln(hardness))+0.5340)}$
Chromium VI, Diss.	Acute	16	µg/l	Numeric standards provided, formula not applicable
	Chronic	11	µg/l	Numeric standards provided, formula not applicable
Copper, Diss.	Acute	50	µg/l	$e^{(0.9422(\ln(hardness))-1.7408)}$
	Chronic	29	µg/l	$e^{(0.8545(\ln(hardness))-1.7428)}$
Lead, Diss.	Acute	281	µg/l	$[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-1.46)}]$
	Chronic	11	µg/l	$[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-4.705)}]$
Manganese, Diss.	Acute	4738	µg/l	$e^{(0.3331(\ln(hardness))+6.4676)}$
	Chronic	2618	µg/l	$e^{(0.3331(\ln(hardness))+5.8743)}$
Nickel, Diss.	Acute	1513	µg/l	$e^{(0.846(\ln(hardness))+2.253)}$
	Chronic	168	µg/l	$e^{(0.846(\ln(hardness))+0.0554)}$
Selenium, Diss.	Acute	18.4	µg/l	Numeric standards provided, formula not applicable
	Chronic	4.6	µg/l	Numeric standards provided, formula not applicable
Silver, Diss.	Acute	22	µg/l	$\frac{1}{2} e^{(1.72(\ln(hardness))-6.52)}$
	Chronic	3.5	µg/l	$e^{(1.72(\ln(hardness))-9.06)}$
Zinc, Diss.	Acute	467	µg/l	$0.978e^{(0.8525(\ln(hardness))+1.0617)}$
	Chronic	405	µg/l	$0.986 e^{(0.8525(\ln(hardness))+0.9109)}$

Regulation 93 – 303(d) List and Total Maximum Daily Loads

This stream segment is not currently listed on the Division's 303(d) list of water quality impacted streams. The Division's Restoration and Protection Unit completed an Ammonia TMDL in 2000, so therefore the total ammonia requirements of this TMDL must be considered for this PEL. For this entity, the TMDL states that the total ammonia limitations should be 25 mg/l. However these old WLA effluent limitations are now unprotective of the stream and the more stringent ammonia limitations developed in the ammonia modeling for this PEL will apply.

This stream segment is on the 305(b) list of potentially water quality impacted streams for impaired Aquatic Life Use. According to Division standard procedure, the Division's Environmental Data Unit investigates issues of water quality standard exceedances. For a receiving water placed on this list, the Restoration and Protection Unit is tasked with developing the Total Maximum Daily Loads (TMDLs) and the Waste Load Allocation (WLAs) to be distributed to the affected facilities. WLAs have not yet been established and the allowable concentration calculated in the following sections may change upon further evaluation by the Division.

IV. Receiving Stream Information

Low Flow Analysis

The Colorado Regulations specify the use of low flow conditions when establishing water quality based effluent limitations, specifically the acute and chronic low flows. The acute low flow, referred to as 1E3, represents the one-day low flow recurring in a three-year interval, and is used in developing limitations based on an acute standard. The 7-day average low flow, 7E3, represents the seven-day average low flow recurring in a 3 year interval, and is used in developing limitations based on a Maximum Weekly Average Temperature standard (MWAT). The chronic low flow, 30E3, represents the 30-day average low flow recurring in a three-year interval, and is used in developing limitations based on a chronic standard.

To determine the low flows available for the various analyses conducted as part of this PEL analysis, a basin-wide flow analysis was utilized. This analysis utilized the latest flow conditions in the ammonia model for the basin from Lewis and McCutchan Report 274. The flows values for upstream and downstream gages were examined as were the seepage and relative locations of diversions and additions to St. Vrain Creek in the immediate area. Flow data from two USGS gage stations located in St. Vrain Creek were used in flow analysis for ammonia modeling. Daily flows from the representative USGS gage stations were obtained and input to U.S. Environmental Protection Agency (EPA) DFLOW software (see modeling Report 274).

The 1E3 and 30E3 low flows calculated using data available for a period of record October 1, 1997, through September 30, 2007, are set forth in Table A-5.

Table A-5

Low Flows for St. Vrain Creek at the SVSD WWTF

Low Flow (cfs)	*Annual*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
30E3	13	39	29	46	13	21	35	19	24	27	38	44	49
7E3	13	37	28	46	13	21	33	19	24	25	38	43	47
1E3	13	36	27	46	13	21	32	19	24	23	38	43	46

During the months of March, April, May, July, August, and October the acute low flow calculated by DFLOW exceeded the chronic low flow. In accordance with Division standard procedures, the acute low flow was thus set equal to the chronic low flow for these months.

The ratio of the 30E3 low flow of St. Vrain Creek to the SVSD WWTF design flow is 1.4:1

The annual 7E3 is 13 cfs from the same data used above.

Mixing Zones

The amount of the available assimilative capacity (dilution) that may be used by the permittee for the purposes of calculating the WQBELs may be limited in a permitting action based upon a mixing zone analysis or other factors. These other factors that may reduce the amount of assimilative capacity available in a permit are: presence of other dischargers in the vicinity; the presence of a water diversion downstream of the discharge (in the mixing zone); the need to provide a zone of passage for aquatic life; the likelihood of bioaccumulation of toxins in fish or wildlife; habitat considerations such as fish spawning or nursery areas; the presence of threatened and endangered species; potential for human exposure through drinking water or recreation; the possibility that aquatic life will be attracted to the effluent plume; the potential for adverse effects on groundwater; and the toxicity or persistence of the substance discharged.

Unless a facility has performed a mixing zone study during the course of the previous permit, and a decision has been made regarding the amount of the assimilative capacity that can be used by the facility, the Division assumes that the full assimilative capacity can be allocated. Note that the review of mixing study considerations, exemptions and perhaps performing a new mixing study (due to changes in low flow, change in facility design flow, channel geomorphology or other reason) is evaluated in every permit and permit renewal.

For this facility, 100% of the available assimilative capacity may be used as the facility has not had to perform a mixing zone study, and the discharge is not to a T&E stream segment. However, this facility will be required to complete a mixing zone study after the WWTF receives its next permit. At that time any changes in the available dilution, if necessary, will be evaluated.

Ambient Water Quality

The Division evaluates ambient water quality based on a variety of statistical methods as prescribed in Section 31.8(2)(a)(i) and 31.8(2)(b)(i)(B) of the *Colorado Department of Public Health and Environment Water Quality Control Commission Regulation No. 31*, and as outlined in the Division's Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits (WQP-19). Ambient water quality is evaluated in this PEL analysis for use in determining assimilative capacities and in completing antidegradation reviews for pollutants of concern, where applicable.

To conduct an assessment of the ambient water quality upstream of the SVSD WWTF, data were gathered from the WQCD and USGS. The WQCD collected data from St. Vrain Creek at mouth (WQCD #29), St. Vrain Creek upstream of Boulder Creek confluence (WQCD #5506) and St. Vrain Creek at Hygiene Road (WQCD #5512). The USGS collected data from St. Vrain Creek below Longmont (USGS #6725450). The period of record for the data was from 2004 to 2009. A summary of the upstream data from this source is presented in Table A-6.

Table A-6

Ambient Water Quality for St. Vrain Creek

Parameter	*Number of Samples*	*15th Percentile*	*50th Percentile*	*85th Percentile*	*Mean*	*Notes*
E. coli (#/100 ml)	26	NA	NA	NA	43	Geomean
TRC (mg/l)	0	NA	NA	0	NA	1
As, TR (µg/l)	10	NA	0	NA	NA	2
As, Dis (µg/l)	10	NA	NA	0	NA	2
Cd, Dis (µg/l)	29	NA	NA	0	NA	2
Cr+3, Dis (µg/l)	10	NA	NA	0	NA	2
Cr+6, Dis (µg/l)	10	NA	NA	0	NA	2
Cu, Dis (µg/l)	29	NA	NA	1.4	NA	2
CN, Free (µg/l)	0	NA	NA	0	NA	2
Fe, TR (µg/l)	28	NA	280	0	NA	2
Pb, Dis (µg/l)	29	NA	NA	0	NA	2
Mn, Dis (µg/l)	29	NA	NA	44	NA	2
Hg, Tot (µg/l)	0	NA	NA	0	NA	2
Ni, Dis (µg/l)	10	NA	NA	0	NA	2
Se, Dis (µg/l)	28	NA	NA	4.15	NA	2
Ag, Dis (µg/l)	10	NA	NA	0	NA	2
Zn, Dis (µg/l)	29	NA	NA	22	NA	2
Note 1 Based on the discussion for total residual chlorine in Section VI of this assessment, the ambient water quality concentration for total residual chlorine has been assumed to be zero.						
Note 2 When sample results were below detection levels, the value of zero was used in accordance with the Division's standard approach for summarization and averaging purposes.						

V. Facility Information and Pollutants Evaluated

Facility Information

The SVSD WWTF is located at is at 111307 Business Park Circle in Firestone, CO in Weld County; at 40° 11' 05" latitude North and 104° 55' 50" longitude West in Weld County. The currently proposed design capacity of the facility is 6 MGD (9.3 cfs). Wastewater treatment is accomplished using a mechanical wastewater treatment process. The technical analyses that follow include assessments of the assimilative capacity based on this design capacity.

An assessment of nearby facilities based on EPA's Permit Compliance System (PCS) database found 206 dischargers in the Weld County area. Almost one-half of the facilities were discharging to another watershed. More than one-half of the facilities conducted construction-related operations (e.g., sand and gravel) and thus had no pollutants of concern in common with the SVSD WWTF. Other facilities were located very far from the SVSD WWTF and thus were not considered relevant to this analysis.

The ambient water quality background concentrations used in the mass-balance equation account for pollutants of concern contributed by upstream sources. Due to the distance between facilities, the ambient water quality background concentrations used in the mass-balance equation (as described in the following section) account for pollutants of concern contributed by upstream sources, and therefore it was not necessary for this PEL to model upstream dischargers together with the SVSD WWTF when determining the available assimilative capacities in St. Vrain Creek at the SVSD WWTF outfall. It is probable that at some time in the future another basin wide modeling effort will need to be done to allocate Total Nitrogen and Total Phosphorus loading to all dischargers in the basin.

Pollutants of Concern

Pollutants of concern may be determined by one or more of the following: facility type; effluent characteristics and chemistry; effluent water quality data; receiving water quality; presence of federal effluent limitation guidelines; or other information. Parameters evaluated in this PEL may or may not appear in a permit with limitations or monitoring requirements, subject to other determinations such as a reasonable potential analysis, mixing zone analyses, 303(d) listings, threatened and endangered species listings or other requirement as discussed in a permit rationale.

The following parameters were identified by the Division as pollutants to be evaluated for this facility:

- Total Residual Chlorine
- BOD5
- TSS
- Oil and Grease
- pH
- *E. coli*
- Ammonia
- Metals and Cyanide

There are no site-specific in-stream water quality standards for BOD_5 or $CBOD_5$, TSS, percent removal, and oil and grease for this receiving stream. Thus, assimilative capacities were not determined for these parameters. The applicable limitations for these pollutants can be found in Regulation No. 62 and will be applied in the permit for the WWTF.

It is the Division's standard procedure to consider metals and cyanide as potential pollutants of concern for all major domestic WWTFs.

According to the *Rationale for Classifications, Standards and Designations of the South Platte River*, stream segment COSPSV03 is not designated a water supply. For this reason, the nitrate standard, which is applied at the point of intake to a water supply, is not evaluated as part of this analysis.

During assessment of the facility, nearby facilities, and receiving stream water quality, no additional parameters were currently identified as pollutants of concern.

VI. Determination of Water Quality Based Effluent Limitations (WQBELs)

<u>Technical Information</u>

Note that the WQBELs developed in the following paragraphs, are calculations of what an effluent limitation may be in a permit. The WQBELs for any given parameter, will be compared to other potential limitations (federal Effluent Limitations Guidelines, State Effluent Limitations, or other applicable limitation) and typically the more stringent limit is incorporated into a permit. If the WQBEL is the more stringent limitation, incorporation into a permit is dependent upon a reasonable potential analysis.

In-stream background data and low flows evaluated in Sections II and III are used to determine the assimilative capacity of St. Vrain Creek near the SVSD WWTF for pollutants of concern, and to calculate the WQBELs. For all parameters except ammonia, it is the Division's approach to calculate the WQBELs using the lowest of the monthly low flows (referred to as the annual low flow) as determined in the low flow analysis. For ammonia, it is the standard procedure of the Division to determine monthly WQBELs using the monthly low flows, as the regulations allow the use of seasonal flows.

The Division's standard analysis consists of steady-state, mass-balance calculations for most pollutants and modeling for pollutants such as ammonia. The mass-balance equation is used by the Division to calculate the WQBELs, and accounts for the upstream concentration of a pollutant at the existing quality, critical low flow (minimal dilution), effluent flow and the water quality standard. The mass-balance equation is expressed as:

$$M_2 = \frac{M_3 Q_3 - M_1 Q_1}{Q_2}$$

Where,

Q_1 = Upstream low flow (1E3 or 30E3)
Q_2 = Average daily effluent flow (design capacity)
Q_3 = Downstream flow ($Q_1 + Q_2$)
M_1 = In-stream background pollutant concentrations at the existing quality
M_2 = Calculated WQBEL
M_3 = Water Quality Standard, or other maximum allowable pollutant concentration

A more detailed discussion of the technical analysis is provided in the pages that follow.

The upstream background pollutant concentrations used in the mass-balance equation will vary based on the regulatory definition of existing ambient water quality. For most pollutants, existing quality is determined to be the 85th percentile. For metals in the total or total recoverable form, existing quality is determined to be the 50th percentile. For pathogens such as fecal coliform and *E. coli*, existing quality is determined to be the geometric mean.

For temperature, the highest 7-day mean (for the chronic standard) of daily average stream temperature, over a seven consecutive day period will be used in calculations of the chronic temperature assimilative capacity, where the daily average temperature should be calculated from a minimum of three measurements spaced equally through the day. The highest 2-hour mean (for the acute standard) of stream temperature will be used in calculations of the acute temperature assimilative capacity. The highest 2-hour mean should be calculated from a minimum of 12 measurements spaced equally through the day.

Calculation of WQBELs

When the ambient water quality exceeds the in-stream standard, the Division standard procedure is to allocate the water quality standard to prevent further degradation of the receiving waters. The Division's Restoration and Protection Unit investigates issues of water quality standard exceedances. This Unit is tasked with determining if the exceedances are valid and placing the receiving stream on the Clean Water Act Section 303(d) list of impaired waters, if appropriate. If the receiving water is placed on the State's 303(d) list, the Assessment Unit is tasked with developing the Total Maximum Daily Loads (TMDLs) and the Waste Load Allocations (WLAs) to be distributed to the affected facilities.

Chlorine: The mass-balance equation was used to determine the WQBELs for chlorine. There are no point sources discharging total residual chlorine within one mile of the SVSD WWTF. Because chlorine is rapidly oxidized, in-stream levels of residual chlorine are detected only for a short distance below a source. Ambient chlorine was therefore assumed to be zero.

Using the mass-balance equation provided in the beginning of Section VI, the acute and chronic low flows set out in Section IV, the chlorine background concentration of zero as discussed above, and the in-stream standards for chlorine shown in Section III, the WQBELs for chlorine were calculated. The data used and the resulting WQBELs, M_2, are set forth in Table A-7.

Table A-7 Chlorine Assimilative Capacities						
Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1 (mg/l)***	***M_3 (mg/l)***	***M_2 (mg/l)***
Acute Chlorine	13.0	9.3	22.3	0	0.019	***0.046***
Chronic Chlorine	13.0	9.3	22.3	0	0.011	***0.026***

E. coli**:** Available studies indicate that *Escherichia coli (E. coli)*, which is a subset of fecal coliform, is a better predictor of potential human health impacts from waterborne pathogens. The Water Quality Control Commission has replaced all standards for fecal coliform with standards for E. coli. Therefore limits for only E. coli are calculated. There are no point sources discharging E. coli within one mile of the SVSD WWTF. Thus, WQBELs were evaluated separately. The data used and the resulting WQBELs, M_2, are set forth in Table A-8.

Table A-8 *E. coli* Assimilative Capacities						
Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1 (#/100 ml)***	***M_3 (#/100 ml)***	***M_2 (#/100 ml)***
E. coli	13.0	9.3	22.3	43	126	242

Temperature:
The 7E3 is 13 cfs so the dilution ratio is 1.4:1. The calculations of the annual 7E3 low flow used the same flow information as that used in calculating the 1E3 and 30E3 low flows. A WQBEL for temperature can only be calculated if there is representative data, in the proper form, to determine what the background Maximum Weekly Average Temperature and Daily Maximum ambient temperatures are. The Weekly Average Effluent Temperature (WAET) will be the highest 7-day mean of daily average effluent temperature over a seven-day consecutive period, with the daily average calculated from a minimum of three measurements spaced equally through the day. The data should be collected on at least a daily basis with at least 4 days occurring in the month of interest. The use of recording thermographs is encouraged, but is not required. As this data is not available at this time, the temperature limitation will be revisited in the future when representative temperature data becomes available.

Metals and Cyanide: Metals and cyanides may be present at large domestic WWTFs that accept discharges from industrial contributors. It is the standard approach of the Division to determine the available assimilative capacities for cyanide and those metals for which ambient water quality standards are available. Using the mass-balance equation provided in the beginning of Section VI, the low flows and background concentrations contained in Section IV, and the in-stream standards for metals and cyanide as shown in Section III, the WQBELs were calculated. The data used and the resulting WQBELs, M_2, are set forth in Table A-9a for chronic standards and in Table A-9b for acute standards.

Table A-9a

Chronic WQBELs for Metals and Cyanide

Parameter	Q_1 (cfs)	Q_2 (cfs)	Q_3 (cfs)	M_1 (μg/l)	M_3 (μg/l)	M_2 (μg/l)
As, TR	13	9.3	22.3	0	7.6	18
Cd, Dis	13	9.3	22.3	0	1.2	2.9
Cr+3, Dis	13	9.3	22.3	0	231	554
Cr+6, Dis	13	9.3	22.3	0	11	26
Cu, Dis	13	9.3	22.3	1.4	29	68
Fe, TR	13	9.3	22.3	280	1,000	2,006
Pb, Dis	13	9.3	22.3	0	11	26
Mn, Dis	13	9.3	22.3	44	2,618	6,216
Hg, Tot	13	9.3	22.3	0	0.01	0.024
Ni, Dis	13	9.3	22.3	0	168	403
Se, Dis	13	9.3	22.3	4.15	4.6	5.2
Ag, Dis	13	9.3	22.3	0	3.5	8.4
Zn, Dis	13	9.3	22.3	22	405	940

Table A-9b

Acute WQBELs for Metals and Cyanide

Parameter	Q_1 (cfs)	Q_2 (cfs)	Q_3 (cfs)	M_1 (μg/l)	M_3 (μg/l)	M_2 (μg/l)
As, Dis	13	9.3	22.3	0	340	815
Cd, Dis	13	9.3	22.3	0	9.1	22
Cr+3, Dis	13	9.3	22.3	0	1,773	4,251
Cr+6, Dis	13	9.3	22.3	0	16	38
Cu, Dis	13	9.3	22.3	1.4	50	118
CN, Free	13	9.3	22.3	0	5	12
Pb, Dis	13	9.3	22.3	0	281	674
Mn, Dis	13	9.3	22.3	44	4,738	11,300
Ni, Dis	13	9.3	22.3	0	1,513	3,628
Se, Dis	13	9.3	22.3	4.15	18.4	38
Ag, Dis	13	9.3	22.3	0	22	53
Zn, Dis	13	9.3	22.3	22	467	1,089

Ammonia: The Ammonia Toxicity Model (AMMTOX) is a software program designed to project the downstream effects of ammonia and the ammonia assimilative capacities available to each discharger based on upstream water quality and effluent discharges. To develop data for the AMMTOX model, an in-stream water quality study should be conducted of the upstream receiving water conditions, particularly the pH and corresponding temperature, over a period of at least one year.

Ammonia is present in the aqueous environment in both ionized and un-ionized forms. It is the un-ionized form which is most toxic, however both forms are toxic to aquatic life. The proportion of total ammonia present in un-ionized form in the receiving stream is a function of the combined upstream and effluent ammonia concentrations, and the pH and temperature of the effluent and receiving stream, combined.

To develop data for the AMMTOX model, an in-stream water quality study must be conducted of the upstream receiving water conditions, particularly the pH and corresponding temperature, over a period of at least one year.

Temperature and corresponding pH data sets reflecting upstream ambient receiving water conditions were available for St. Vrain Creek based on a study conducted by Lewis and McCutchan for the St. Vrain Sanitation District. Effluent pH and temperature data were also available from the SVSD study and were used to establish the average facility contributions in the AMMTOX model.

The AMMTOX model may be calibrated for a number of variables in addition to the data discussed above. The values used for the other variables in the model are listed below:

- Stream velocity = $0.3Q^{0.4d}$
- Default ammonia loss rate = 6/day
- pH amplitude was assumed to be medium
- Default times for pH maximum, temperature maximum, and time of day of occurrence
- pH rebound was set at the default value of 0.2 s.u. per mile
- Temperature rebound was set at the default value of 0.7 degrees C per mile.

The results of the ammonia analyses for the SVSD WWTF are presented in Table A-10.

Table A-10

AMMTOX Results for St. Vrain Creek at the SVSD WWTF

Month	Total Ammonia, chronic (mg/l)	Total Ammonia, acute (mg/l)
January	13	14
February	10	14
March	9.2	19
April	7.7	18
May	8.2	24
June	7.5	40
July	4.9	41
August	4.7	43
September	6.3	36
October	13	41
November	22	35
December	21	25

Agricultural Use Parameters (SAR, Na and EC):

Section 31.11(1)(a)(iv) of *The Basic Standards and Methodologies for Surface Waters* (Regulation No. 31) includes the narrative standard that State surface waters shall be free of substances that are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life. The interpretation of these conditions (i.e., “no harm to plants” and “no harm to the beneficial uses”) and how they were to be applied in permits were contemplated by the Division as part of an Agricultural Work Group, and culminated in the most recent policy entitled *Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops* (hereafter the Narrative Standards policy)

The discharge is from a domestic WWTF that receives only typical domestic sewage influent and the TDS of the effluent is less than 800 mg/l. Therefore in accordance with the Division’s Narrative Standard Policy WQP-24, no SAR or ECs limitations are required.

VII. Antidegradation Evaluation

As set out in *The Basic Standards and Methodologies for Surface Water*, Section 31.8(2)(b), an antidegradation analysis is required except in cases where the receiving water is designated as “Use Protected.” Note that “Use Protected” waters are waters “that the Commission has determined do not warrant the special protection provided by the outstanding waters designation or the antidegradation review process” as set out in Section 31.8(2)(b). The antidegradation section of the regulation became effective in December 2000, and therefore antidegradation considerations are applicable to this PEL analysis.

According to the *Classifications and Numeric Standards for South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin*, stream segment COSPSV03 is Undesignated. Thus, an antidegradation review is required for this segment if new or increased impacts are found to occur.

Introduction to the Antidegradation Process

The antidegradation process conducted as part of this Preliminary Effluent Limits analysis is designed to determine if an antidegradation review is necessary and if necessary, to complete the required calculations to determine the limits that can be selected as the antidegradation-based effluent limit (ADBEL), absent further analyses that must be conducted by the facility.

As outlined in the *Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance* (AD Guidance), the first consideration of an antidegradation evaluation is to determine if new or increased impacts are expected to occur. This is determined by a comparison of the newly calculated WQBELs verses the existing permit limitations in place as of September 30, 2000, and is described in more detail in the analysis. Note that the AD Guidance refers to the permit limitations as of September 30, 2000 as the existing limits.

If a new or increased impact is found to occur, then the next step of the antidegradation process is to go through the significance determination tests. These tests include: 1) bioaccumulative toxic pollutant test; 2) temporary impacts test; 3) dilution test (100:1 dilution at low flow) and; 4) a concentration test.

As the determination of new or increased impacts, and the bioaccumulative and concentration significance determination tests require more extensive calculations, the Division will begin the antidegradation evaluation with the dilution and temporary impact significance determination tests. These two significance tests may exempt a facility from further AD review without the additional calculations.

Note that the antidegradation requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the antidegradation review; however, where there is only an acute standard, the acute standard should be used. The appropriate standards are used in the following antidegradation analysis.

Significance Tests for Temporary Impacts and Dilution

The ratio of the chronic (30E3) low flow to the design flow is 1.4:1, and is less than the 100:1 significance criteria. Therefore this facility is not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue. This facility will also not be a temporary discharge, therefore not a temporary impact.

For the determination of a new or increased impact and for the remaining significance determination tests, additional calculations are necessary. Therefore, at this point in the antidegradation evaluation, the Division will go back to the new or increased impacts test. If there is a new or increased impact, the last two significance tests will be evaluated.

New or Increased Impact

To determine if there is a new or increased impact to the receiving water, a comparison of the new WQBEL concentrations and loadings verses the concentrations and loadings as of September 30, 2000, needs to occur. If either the new concentration or loading is greater than the September 2000 concentration or loading, then a new or increased impact is determined. If this is a new facility (commencement of discharge after September 30, 2000) it is automatically considered a new or increased impact.

This facility was not in place as a discharger to the mainstem of St. Vrain Creek (COSPSV03) as of September 30, 2000, as the discharge was permitted to COSPSV06 (Oxbow lake). Therefore this is automatically considered a new or increased impact. The antidegradation review must continue to the next two significance tests (bioaccumulative and concentration). To evaluate these significance tests the antidegradation limitations need to be calculated.

Determination of Baseline Water Quality (BWQ)

The BWQ is the ambient condition of the water quality as of September 30, 2000. The BWQ defines the baseline low flow pollutant concentration, and for bioaccumulative toxic pollutants, the baseline load.

The BWQ is to take into account the influence of the discharger if the discharge was in place prior to September 30, 2000. In such a case, data from a downstream location should be used to determine the BWQ. If only upstream data is available, then a mass balance equation may be applied, using the facilities effluent data to determine the BWQ. If the discharge was not present prior to September 30, 2000, then the influence of that discharge would not be taken into account in determining the BWQ.

Consistent with current Division procedures, the BWQ concentrations for all pollutants of concern with water quality standards should be established so that it can be used as part of an antidegradation review.

Because the SVSD WWTF was not in existence as a discharger to St. Vrain Creek as of September 30, 2000, the influence of this discharger is not considered when determining the BWQ. Data collected at WQCD Station # 30, located a few miles upstream from the SVSD WWTF, were available for a period of record of January 1998 through September 2004 for the following pollutants.

The BWQ concentrations based on these data, represented by the 50^{th} percentile for total recoverable metals and total metals, the geometric mean for coliforms, and the 85^{th} percentile for dissolved metals, and other pollutants, are summarized in Table A-11.

Table A-11

BWQ Concentrations for Potential Pollutants of Concern For a Facility Not Existing Prior to September 30, 2000

E. coli (#/100 ml)	>126
TRC (mg/l)	0
As, TR (µg/l)	0
As, Dis (µg/l)	0
Cd, Dis (µg/l)	0
Cr+3, Dis (µg/l)	0
Cr+6, Dis (µg/l)	0
Cu, Dis (µg/l)	3.3
CN, Tot (µg/l)	0
CN, Free (µg/l)	0
Fe, TR (µg/l)	430
Pb, Dis (µg/l)	0
Mn, Dis (µg/l)	2,326
Hg, Tot (µg/l)	0
Ni, Dis (µg/l)	1
Se, Dis (µg/l)	3
Ag, Dis (µg/l)	0
Zn, Dis (µg/l)	285

In cases where the BWQ concentration exceeds the water quality standard, the calculated BWQ concentration must then be set equal to the water quality standard. This occurred for *E. coli*.

Significant Concentration Threshold

The SCT is defined as the BWQ plus 15% of the baseline available increment (BAI), and is calculated by the following equation:

$$SCT = (0.15 \times BAI) + BWQ$$

The BAI is the concentration increment between the baseline water quality and the water quality standard, expressed by the term (WQS – BWQ). Substituting this into the SCT equation results in:

$$SCT = 0.15 \times (WQS\text{-}BWQ) + BWQ$$

Where,

WQS = Chronic standard or, in the absence of a chronic standard, the acute standard
BWQ = Value from Table A-11

When the BWQ concentration is equal to zero, the following equation results:

$$SCT = 0.15 \times WQS$$

The AMMTOX model is used to determine the SCTs for ammonia. Because the new ammonia standard is based on a function of the pH and temperature of the receiving stream, the WQS changes moving downstream from a discharge point. The BWQ and the SCT also change moving downstream. The AMMTOX model calculates these values for every tenth of a mile, for up to 20 miles. Therefore, the SCT is not shown here but is available from examination of the AMMTOX model.

Determination of the Antidegradation Based Average Concentrations

Antidegradation based average concentrations (ADBACs) are determined for all parameters except ammonia, by using the mass-balance equation, and substituting the SCT in place of the water quality standard, as shown in the following equation:

$$ADBAC = \frac{SCT \times Q_3 - M_1 \times Q_1}{Q_2}$$

Where,

Q_1 = Upstream low flow (1E3 or 30E3 based on either the chronic or acute standard)
Q_2 = Current design capacity of the facility
Q_3 = Downstream flow (Q_1 + Q_2)
M_1 = Current ambient water quality concentration (From Section III)
SCT = Significant concentration threshold

The ADBACs were calculated using the SCTs, and are set forth in Table A-12a.

ADBACs for total ammonia are calculated by substituting the SCT in place of the chronic standard in the AMMTOX model, which generates monthly ADBACs as shown in Table A-12b.

Table A-12a
SCTs and ADBACs

Pollutant	*SCT*	*ADBAC*
E. coli (#/100 ml)	126	NA
TRC (mg/l)	0.0017	0.0041
As, TR (µg/l)	1.14	2.7
Cd, Dis (µg/l)	0.18	0.43
Cr+3, Dis (µg/l)	35	84
Cr+6, Dis (µg/l)	1.65	4.0
Cu, Dis (µg/l)	7.2	15
CN, Free (µg/l)	0.75	1.8
Fe, TR (µg/l)	516	845
Pb, Dis (µg/l)	1.64	4.0
Mn, Dis (µg/l)	2,370	5,621
Hg, Tot (µg/l)	0.0015	0.0036
Ni, Dis (µg/l)	26	62
Se, Dis (µg/l)	3.2	3.2*
Ag, Dis (µg/l)	0.52	1.3
Zn, Dis (µg/l)	303	696

* - Set equal to SCT because SCT < current ambient quality (Table A-6).

Table A-12b
ADBACs for Ammonia

January	5.1
February	5.2
March	5.4
April	2.7
May	2.8
June	2.7
July	2.1
August	2.1
September	2.4
October	3.7
November	5.5
December	6.1

Non Impact Limits (NILs) and Antidegradation Based Effluent Limitations (ADBELs)

The ADBEL is defined as the potential limitation resulting from the AD evaluation, and may be either the ADBAC, the NIL, or may be based on the concentration associated with the threshold load concentration (for the bioaccumulative toxic pollutants). ADBACs and TL have already been determined in the AD evaluation, and therefore to complete the evaluation, the NILs need to be determined.

As this facility was not discharging to COSPSV03 as of 9/30/00, the NILs are not an option as the facility was not permitted in September of 2000 and therefore there are no existing permit limits or existing permitted loads. The WQBELs, NIL and ADBACs are shown in Table 13.

Table A-13

Final Selection of WQBELs, NILs, and ADBACs

Pollutant	*NIL*	*WQBEL*	*ADBAC*
E. coli (#/100 ml)	NA	242	NA
TRC (mg/l)	NA	0.026	0.0041
NH3, Tot (mg/l) Jan	NA	13	5.1
NH3, Tot (mg/l) Feb	NA	10	5.2
NH3, Tot (mg/l) Mar	NA	9.2	5.4
NH3, Tot (mg/l) Apr	NA	7.7	2.7
NH3, Tot (mg/l) May	NA	8.2	2.8
NH3, Tot (mg/l) Jun	NA	7.5	2.7
NH3, Tot (mg/l) Jul	NA	4.9	2.1
NH3, Tot (mg/l) Aug	NA	4.7	2.1
NH3, Tot (mg/l) Sep	NA	6.3	2.4
NH3, Tot (mg/l) Oct	NA	13	3.7
NH3, Tot (mg/l) Nov	NA	22	5.5
NH3, Tot (mg/l) Dec	NA	21	6.1
As, TR (µg/l)	NA	18	2.7
Cd, Dis (µg/l)	NA	2.9	0.43
Cr+3, Dis (µg/l)	NA	554	84
Cr+6, Dis (µg/l)	NA	26	4.0
Cu, Dis (µg/l)	NA	68	15
CN, Free (µg/l)	NA	12	1.8
Fe, TR (µg/l)	NA	2,006	845
Pb, Dis (µg/l)	NA	26	4.0
Mn, Dis (µg/l)	NA	6,216	5,621
Hg, Tot (µg/l)	NA	0.024	0.0036
Ni, Dis (µg/l)	NA	403	62
Se, Dis (µg/l)	NA	5.2	3.2
Ag, Dis (µg/l)	NA	8.4	1.3
Zn, Dis (µg/l)	NA	940	696

Alternatives Analysis

If the permittee does not want to accept an effluent limitation that results in no increased impact (NIL) or in insignificant degradation (ADBAC), the applicant may conduct an alternatives analysis (AA). The AA examines alternatives that may result in no degradation or less degradation, and are economically, environmentally, and technologically reasonable. If the proposed activity is determined to be important economic or social development, a determination shall be made whether the degradation that would result from such regulated activity is necessary to accommodate that development. The result of an AA may be an alternate limitation between the ADBEL and the WQBEL, and therefore the ADBEL would not being applied. This option can be further explored with the Division. See Regulation 31.8 (3)(d), and the Antidegradation Guidance for more information regarding an alternatives analysis.

For a PEL, an AA must already be completed in conjunction with the facility's site application. Where the facility makes a reasonable effort to identify and assess less-degrading alternatives and can demonstrate that these alternatives are not economically feasible, the alternatives analysis that currently must be completed as part of the site application should be sufficient to satisfy the antidegradation review requirements set forth in *The Basic Standards and Methodologies for Surface Water, Regulation 31*, Section 31.8(3)(d).

VIII. Regulatory Analysis

Regulation No. 62, the Regulations for Effluent Limitations, includes effluent limitations that apply to all discharges of wastewater to State waters, with the exception of storm water and agricultural return flows.

Table A-14 contains a summary of the applicable limitations for pollutants of concern at this facility.

Table A-14

Specific Limitations for the Discharge of Wastes

Parameter	***7-Day Average***	***30-Day Average***	***Instantaneous Maximum***
BOD_5	45 mg/l	30 mg/l	NA
TSS, mechanical plant	45 mg/l	30 mg/l	NA
TSS, aerated lagoon	110 mg/l	75 mg/l	NA
TSS, non-aerated lagoon	160 mg/l	105 mg/l	NA
BOD_5 Percent Removal	NA	85%	NA
TSS Percent Removal	NA	85%	NA
Total Residual Chlorine	NA	NA	0.5 mg/l
pH	NA	NA	6.0-9.0 s.u. range
Oil and Grease	NA	NA	10 mg/l

Section 62.4(1) of the *Regulations for Effluent Limitations* also indicates that numeric limitations for fecal coliform shall be determined. The State has developed the *Procedure for Selection of Fecal Coliform Limitations Permit Conditions* that specifies a 30-day geometric mean maximum limit of 6,000 colonies per 100 ml and a 7-day geometric mean maximum limit of 12,000 colonies per 100 ml when the ratio of the receiving stream flow to design flow is greater than ten to one. The *Procedure for Selection of Fecal Coliform Limitations Permit Conditions* also specifies that the 7-day geometric mean limit must be calculated as two times the 30-day geometric mean limit. Comparably, for *E. coli*, the Division establishes the 7-day geometric mean limit as two times the 30-day geometric mean limit and also includes maximum limits of 2,000 colonies per 100 ml (30-day geometric mean) and 4,000 colonies per 100 ml (7-day geometric mean).

IX. Preliminary Effluent Limits

The potential PELs reflected in Table A-15 include the consideration of the following:

- Assimilative capacities as discussed in the technical analysis contained in Section VI
- ADBACs as discussed in the antidegradation review provided in Section VII
- NILs, which are zero in this case, as discussed in Section VII
- Effluent limits based on narrative standards, as shown in Section III
- Effluent limits prescribed by the regulations based on the regulatory analysis provided in Section VIII.

Table A-15

St. Vrain Sanitation District

Preliminary Effluent Limits for Discharge to St. Vrain Creek

Technology Based Limits	
BOD_5 (mg/l)	45 (7-day average), 30 (30-day average)
BOD_5 (% removal)	85 (30-day average)
TSS, mechanical plant (mg/l)	45 (7-day average), 30 (30-day average)
TSS, mechanical plant (% removal)	85 (30-day average)
Oil and Grease (mg/l)	10 (maximum)
pH (s.u.)	6.5-9.0 (minimum-maximum)

Total Ammonia		
Month	*WQBEL (mg/l)*	*ADBAC (mg/l)*
January	14 (Daily Max.), 13 (30-day average)	5.1 (2-yr average)
February	14 (Daily Max.), 10 (30-day average)	5.2 (2-yr average)
March	19 (Daily Max.), 9.2 (30-day average)	5.4 (2-yr average)
April	18 (Daily Max.), 7.7 (30-day average)	2.7 (2-yr average)
May	24 (Daily Max.), 8.2 (30-day average)	2.8 (2-yr average)
June	40 (Daily Max.), 7.5 (30-day average)	2.7 (2-yr average)
July	41 (Daily Max.), 4.9 (30-day average)	2.1 (2-yr average)
August	43 (Daily Max.), 4.7 (30-day average)	2.1 (2-yr average)
September	36 (Daily Max.), 6.3 (30-day average)	2.4 (2-yr average)
October	41 (Daily Max.), 13 (30-day average)	3.7 (2-yr average)
November	35 (Daily Max.), 22 (30-day average)	5.5 (2-yr average)
December	25 (Daily Max.), 21 (30-day average)	6.1 (2-yr average)

Other Parameters		
	WQBEL	*ADBAC*
TRC (mg/l)	0.046 (Daily Max.), 0.026 (30-day average)	0.0041 (2-yr average)
Ag (dis) *(µg/l)*	53 (Daily Max.), 8.4 (30-day average)	1.3 (2-yr average)
As (trec) *(µg/l)*	18 (30-day average)	2.7 (2-yr average)
As (dis) *(µg/l)*	815 (Daily Max.)	NA
Cd (dis) *(µg/l)*	22 (Daily Max.), 2.9 (30-day average)	0.43 (2-yr average)
CrIII (dis) *(µg/l)*	4,251 (Daily Max.), 554 (30-day average)	84 (2-yr average)
CrVI (dis) *(µg/l)*	38 (Daily Max.), 26 (30-day average)	4.0 (2-yr average)
Cu (dis) *(µg/l)*	118 (Daily Max.), 68 (30-day average)	15 (2-yr average)
Fe (trec) *(µg/l)*	2,006 (30-day average)	846 (2-yr average)
Hg (tot) *(µg/l)*	0.024 (30-day average)	0.004 (2-yr average)
Mn (dis) *(µg/l)*	11,300 (Daily Max.), 6,216 (30-day average)	5621 (2-yr average)
Ni (dis) *(µg/l)*	3,628 (Daily Max.), 403 (30-day average)	62 (2-yr average)
Pb (dis) *(µg/l)*	674 (Daily Max.), 26 (30-day average)	4.1 (2-yr average)
Se (dis) *(µg/l)*	38 (Daily Max.), 5.2 (30-day average)	3.2 (2-yr average)
Zn (dis) *(µg/l)*	1,089 (Daily Max.), 940 (30-day average)	696 (2-yr average)
Temperature (Cº)	Monitor	NA
CN (Free) (mg/l)	0.012 (Daily Max.)	0.002 (2-yr average)
E. coli (#/100 ml)	484 (7-day average), 242 (30-day average)	NA

According to the model results found at the end of Section IV, the calculated As(trec) WQBEL is more stringent than the chronic WQBEL and therefore the imposition of the acute WQBEL, only, as a daily maximum limit, is also protective of both the acute and chronic As(Dis) water quality standards.

X. References

Regulations:

The Basic Standards and Methodologies for Surface Water, Regulation 31, Colorado Department Public Health and Environment, Water Quality Control Commission, effective January 1, 2011.

Classifications and Numeric Standards for South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin, Regulation No. 38, Colorado Department Public Health and Environment, Water Quality Control Commission, effective 3/30/2010

Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List , Regulation 93, Colorado Department Public Health and Environment, Water Quality Control Commission, effective April 30, 2010.

Policy and Guidance Documents:

Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, December 2001.

Memorandum Re: First Update to (Antidegradation) Guidance Version 1.0, Colorado Department Public Health and Environment, Water Quality Control Division, April 23, 2002.

Rationale for Classifications, Standards and Designations of Segments of the South Platte River, Colorado Department Public Health and Environment, Water Quality Control Division, effective July 10, 2009.

Policy Concerning Escherichia coli versus Fecal Coliform, CDPHE, WQCD, July 20, 2005.

Procedure for Selection of Fecal Coliform Limitations Permit Conditions, CDPHE, WQCD, April 7, 1976.

Colorado Mixing Zone Implementation Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, effective April 2002.

Policy for Conducting Assessments for Implementation of Temperature Standards in Discharge Permits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-23, effective July 3, 2008.

Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-24, effective March 10, 2008.

Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-19, effective May 2002.

Report 264, Ammonia Modeling in the St. Vrain Creek Basin, Dr. Bill Lewis, and Dr. James McCutchan, CU Center of Limnology, 2002